

Model ADPM-1A & 2A Instruction & Maintenance Manual Digital Portable Test Unit Corrosion - Deposit Monitor

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I. Introduction

A. Description of Unit.

The ADPM-1A is a self-contained, portable system for monitoring corrosion and deposition characteristics of cooling water systems. Model ADPM-2A voltage requirement is 220 VAC, all other features are the same as ADPM-A1.

The standard ADPM-1A includes frame, panel, valve, strainer, flow switch, flow meter, 115 VAC meter, specimen holder and heat exchange assembly, voltage control adjustment and corrosion coupon holder. Standard pipe material is 3/4" Schedule 80 PVC. Option A adds a digital display of both temperature and voltage. Three temperature measurements are provided - incoming water, skin temperature and discharge temperature.

The sampling unit consists of a glass tube and a 600 watt cartridge heater. The heating element acts as a catalyst that increases the rate of deposition in the specimen tube. Speeding deposition gives the user an idea of the amount of deposits which can be expected from the system over a long period of time.

The deposit monitor requires a minimum pressure drop of 10 psi to maintain flow through the piping and test specimen.

The flow switch device is included for safety. If flow through the deposit sampling unit drops below 1 gpm, power to the heating element is interrupted. Power to the heater remains off as long as no flow condition exists.

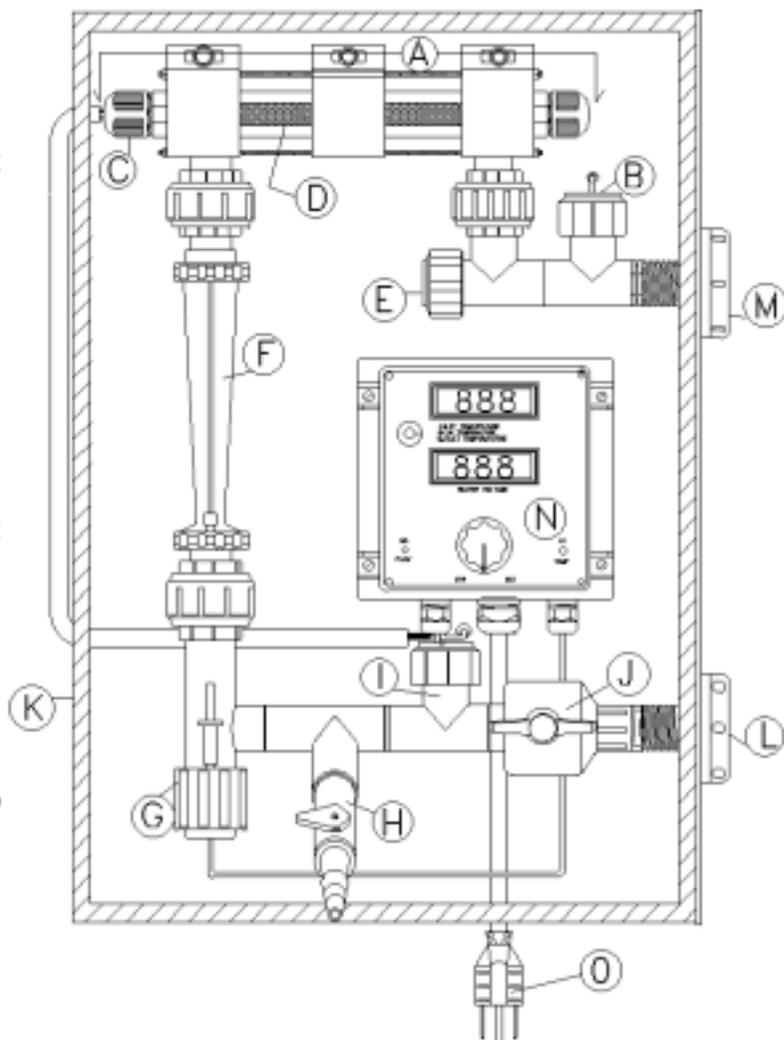
Water flow and heat input can be varied to create any desired cooling system condition.

The heat test chamber design has been tested at 80 psi at 190°F for 4 hours.

Every ADPM-1A is pressure tested before shipment for leaks at 50 psi. Higher pressures may cause leaks at the tube fittings. These leaks can be controlled by tightening the compression nuts or replacing the O-rings.

CAUTION: Always disconnect the ADPM-1A or any other electrical equipment from the main power supply before performing any mechanical work.

- Ⓐ = TEST HEAT EXCHANGER
- Ⓑ = OUTGOING WATER TEMPERATURE
- Ⓒ = TUBE HEATER/EXCHANGER TEMPERATURE PROBE
- Ⓓ = SPECIMEN TUBE
- Ⓔ = CORROSION COUPON HOLDER
- Ⓕ = FLOW METER
- Ⓖ = FLOW SWITCH
- Ⓗ = SAMPLE PORT
- Ⓘ = INCOMING WATER TEMPERATURE PROBE
- ⓵ = SHUT-OFF VALVE
- Ⓚ = FRAME
- Ⓛ = 3/4" WATER INLET PORT
- Ⓜ = 3/4" WATER INLET PORT
- Ⓝ = TEMPERATURE CONTROLLER AND DISPLAY
- Ⓞ = POWER CORD



II. Placement and Installation

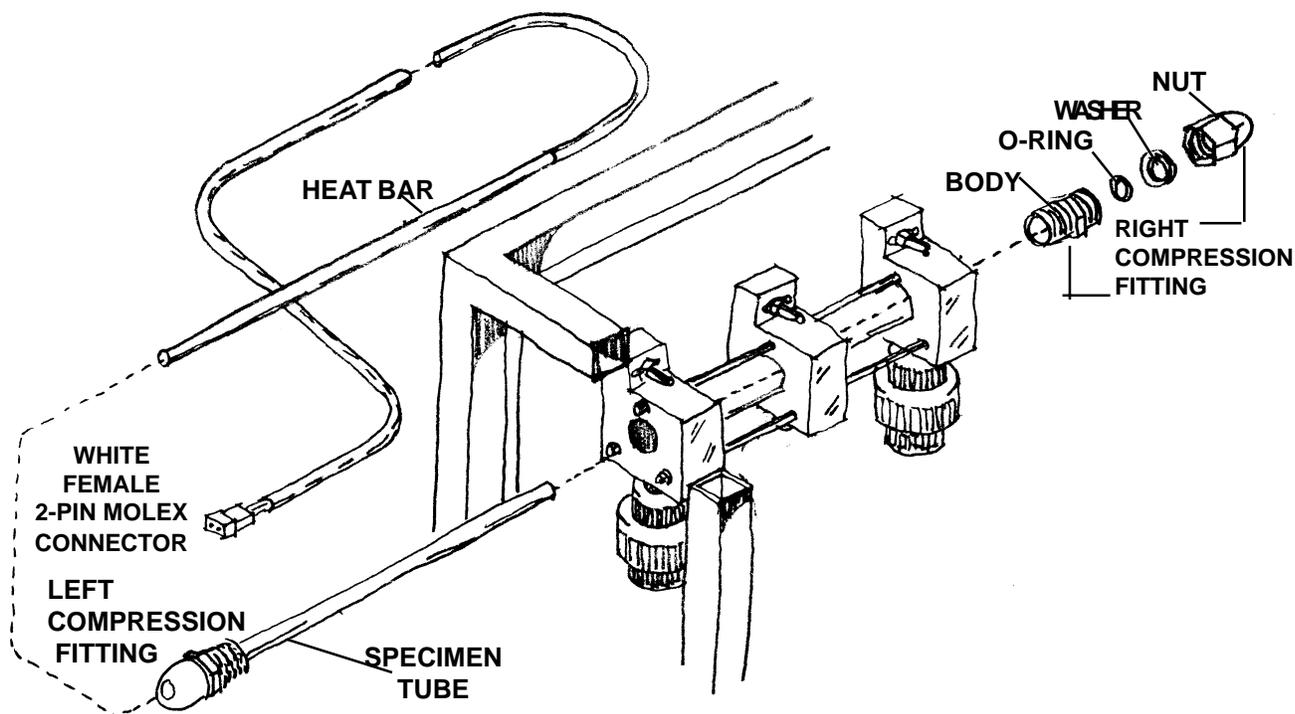
- A. Place the ADPM-1A in an area reasonably protected from weather, construction activity and corrosive plant environments. Plumbing methods are dictated by plant safety procedures and specifications.
- B. Each ADPM-1A is tested at 50 psi before shipment. At higher pressures, the unit may develop leaks at various fittings. This leaking can be controlled by tightening the compression nuts or replacing the O-rings. Do not exceed a water pressure of 80 psi.
- C. A minimum pressure of 10 psi will maintain satisfactory flow through the piping and across the specimen.
- D. The strainer in the ADPM-1A inlet water supply line must be installed with the flushing valve assembly pointed toward the ground. Arrows on the strainer indicate the proper direction of flow. Correct water flow direction through the strainer is imperative.

III. Removing Specimen Tube

- A. Disconnect main power supply. Let ADPM-1A sit for at least one minute.
- B. Turn off water supply and relieve any pressure by opening the flush valve.
- C. Slide heat element out to remove.
- D. Remove the two plastic end fitting nuts and washers. (See page 5 for illustration).
- E. Remove O-rings by sliding specimen tubes left and right about 1/4 inch to break O-ring loose. Slip the ring off the tube.
- F. Unscrew left compression fitting. Remove fitting and tube as one piece. Slide it to the left. Do not touch or scrape the tube on the mounting block openings.

NOTES: 1.) Inspect heating element each time it is removed from a specimen tube. If deposition, rust or water salts are evident in minute amounts, wash the heating element in clear water. Then use steel wool or fine-grade emery cloth to remove the deposits. Wash the element again with clear water and dry it thoroughly.

- 2) Clean flow switch when specimen tube is pulled.



Removal and Replacement of Specimen Tube

IV. Specimen Tube Installation

- A. Disconnect main power supply. Let ADPM-1A sit for at least one minute.
- B. Shut off water supply.
- C. Remove two end nuts, plastic washers and O-rings from each end of the test chamber.
- D. Check to see if test chamber is dry. If not, raise the right end of the unit 6 to 8 inches to allow excess water to drain from the test chamber.

NOTE: If test chamber has excess water in bottom area of the glass tube, do not allow this water to contact the inside surfaces of the specimen tube. Any water trapped inside the tube will very quickly evaporate as the heating element is applied. Salts from this evaporation make it nearly impossible to remove heating element from the specimen tube at the end of your test.

- E. From the left end of the test chamber, carefully slide the specimen tube through the male compression body and into the test chamber.
- F. With the specimen tube ends evenly positioned at each end of the test condenser, slide 1 O-ring and one plastic washer onto each end. Be careful to place the flat side of the washer against the O-ring. (If the beveled side of the washer is placed against it, the O-ring will not be compressed and the tube will leak.)

V. Operation

- A. Turn off main power.
- B. Set the voltage control at zero (0).
- C. Install a prepared specimen tube in the heat test chamber and install the heater. (See Removing Specimen Tubes, Page 4)
- D. Using the gpm to fps water flow curve (page 10) establish the flow desired with the metering ball valve. Check for leaks. Stop all leaks before activating the electrical portion of the ADPM-1A (See Wet Side Troubleshooting, Page 9)
- E. Plug the power supply cord into a convenient outlet.
- F. Leave the voltage control set at zero (no heat to test the specimen.)
- G. Using the heat flux curve (Page 10) dial the desired voltage with the voltage control.

Note: The heat flux (or heat-transfer rate) for any given voltage can be calculated by:

$$U = E^2 \times 1.14$$

where U = heat flux in Btu/ft²/hr
E = voltmeter reading

VI. Flow Switch Adjustment and Reset Operation

A. Establishing Minimum Flow.

To establish minimum flow to prevent overheating.

- A. Turn the main power on and leave the voltage control at zero (0) (no heat to the exchanger).
- B. Establish the minimum flow desired with the throttle valve and flowmeter. The minimum flow should be no less than 1 gpm (gallon per minute).
- C. Increase the water flow to the desired level for your test.
- D. Use the voltage control to dial the desired voltage for the test.

B. Flow Switch Reset

The flow switch circuit is normally open and preset to trip at 1 gpm. If flow through the heat exchanger drops below the flow switch set point, electrical power to the heat exchanger is interrupted. Power to the heater will remain off as long as a no flow condition exists. Voltage will return to the heat exchanger when flow returns to the ADPM-1A (See cleaning the flow switch, page 7)

Note: The flow switch device is a safety feature. To ensure that this device is functioning properly, follow these steps each time a new specimen tube is installed.

VII. Cleaning the Flow Switch

- A. Unplug the unit from the main electrical power source. Let sit for at least one minute.
- B. Turn off water flow.
- C. Remove the flow switch cap. (Unscrew by hand.)
- D. Lift plunger out.
- E. With soap and water, scrub deposits on the piston. Use a medium test tube brush to clean out the sight glass cavity with a rotating motion. Do not use paper towels or cloth, since lint or small pieces of paper will affect the switch operation. With the metering valve open and the flow switch disassembled, flush water through the switch.
- F. Replace the plunger (magnet end up), and cap. Lubricate the cap sealing the O-ring with silicone or silicone spray only. If the plunger is installed backwards, the unit will not function.
- G. The flow switch is a safety device for detecting low flow and cutting off power to the heater. Clean it each time a new test specimen is installed. An accumulation of deposits or scale can jam the plunger in the open position and the switch will not cut off when a low flow condition occurs.

VIII. Cleaning the Strainer

- A. The strainer contains a screen that must be cleaned regularly to avoid flow interruption.
- B. For quick cleaning, open the flush valve. This directs the flow of water through the center portion of the screen, removing accumulated debris.
- C. Periodically, disassemble the strainer for a more thorough cleaning. Loosen the strainer bonnet and pull the top assembly free from the body. Clean the screen with a test tube brush, then reassemble the strainer. Make sure the screen support is not left out.

IX. Electrical Control Panel Removal

- A. Disconnect the ADPM-1A from the main power supply. Let sit for at least 1 minute.
- B. Turn water off.
- C. Loosen the 4 panhead screws around the outer edges of electrical control panel.
- D. Carefully lift out the panel far enough to reach the Molex connector on the wires to the voltage meter. Disconnect the meter and remove electrical control panel.

X. Electrical Side Troubleshooting

Disconnect the ADPM-1A from the power supply before doing any work on it.

1. If the unit is totally out:
 - a. Check the main power source. Do you have electricity?
 - b. Check the main power cord. Has it been damaged? Does it work?
 - c. Check the coupling plug assembly behind the panel. Is it connected and tightly fastened?
 - d. If the unit still does not function as it should, return it to factory for repairs.
2. If the display does not function:
 - a. Remove the panel and check for a loose connection.
 - b. Replace the display. (Send panel to factory)
3. If the panel works, but the heater doesn't:
 - a. Replace the heater.
 - b. Remove the panel and check for a loose connection.
4. If the panel works, but the unit will not reset.
 - a. Is the flow switch plugged into the ADPM-1A?
 - b. Clean the flow switch. (See Cleaning flow Switch, Page 7.)
 - c. Is the plunger installed correctly?
 - d. Replace the flow switch
 - e. Check heat of right end block by touching. Unit is equipped with 212°F thermal overload and will reset only after cooling to 190°F. If experiencing continual kickoff from thermal overload, increase velocity of water.

NOTE: Always start or reset ADPM-1A or ADPM-2A with the Voltage control set at zero. This eliminates extraneous electrical spikes on the system .

The flow switch device is a safety feature. To be sure it is function properly, check this item each time a new specimen tube is installed. (See Flow Switch Adjustment and Operation, Page 7)

XI. Wet Side Troubleshooting

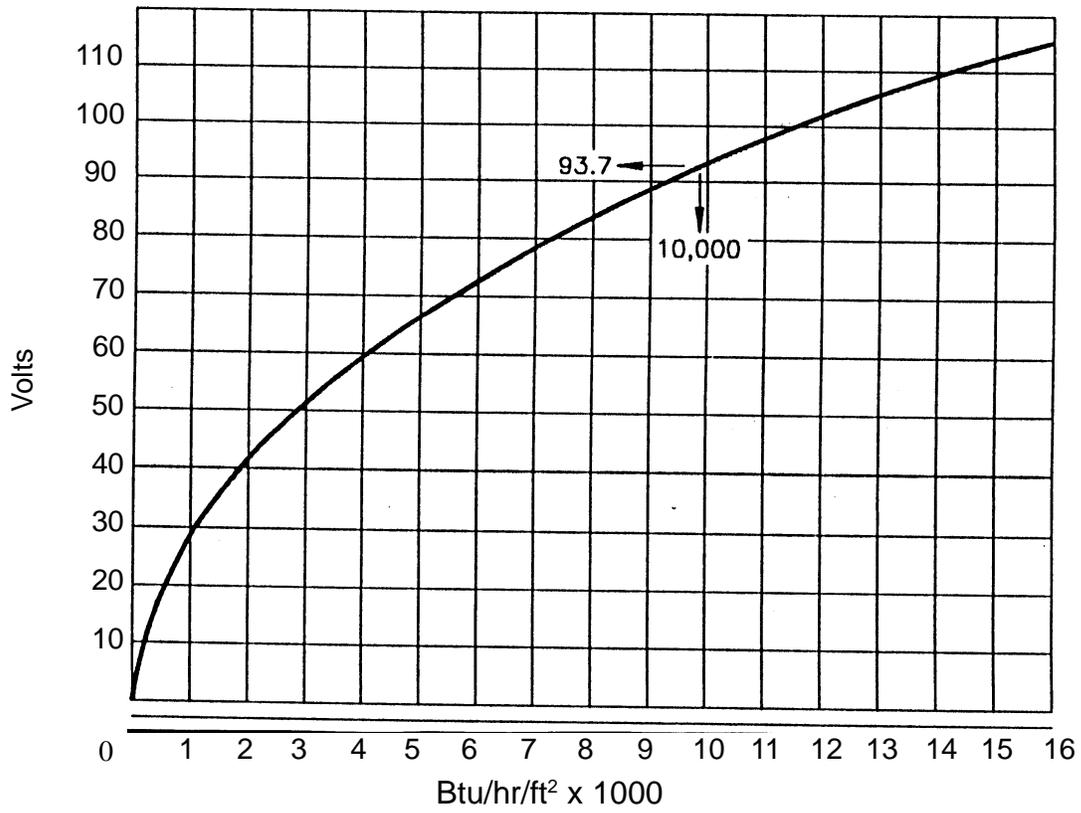
- A. Erratic or unsatisfactory water flow can occur if the pressure is below 10 psi. If this happens, move the unit to a location where this pressure can be achieved or use booster pump.
- B. Leaks can occur if the water pressure exceeds 50 psi. Tighten the compression nuts or replace the O-rings (OR-012) to stop the leak.

Check to be sure that flat side of the plastic washer is against the O-ring. (If the bevelled side of the washer is placed against it, the O-ring will not be compressed and leakage will occur.)

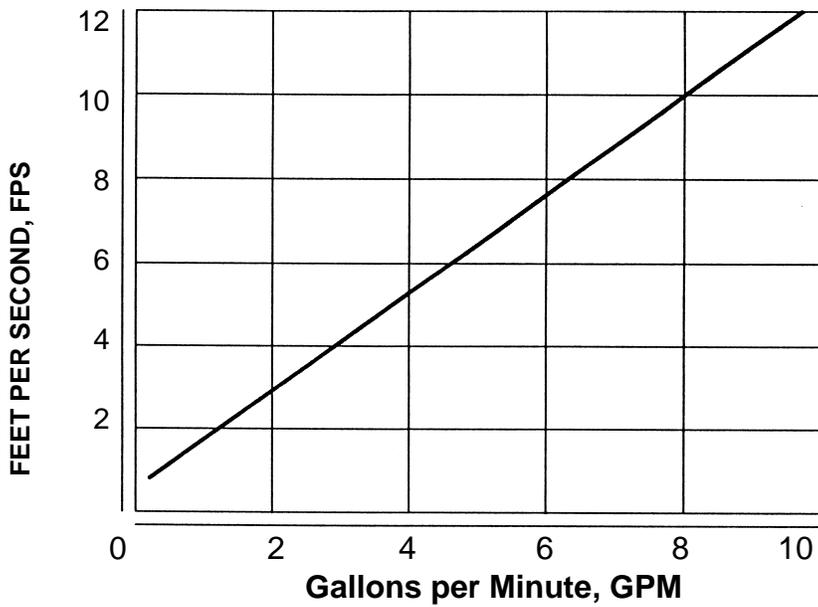
- C. Heat test chamber leaks are common in the area where the end blocks and glass tube come together. If the test chamber leaks:

Tighten the tie rod nuts at each end of the exchanger block. If this does not stop the leak, replace the O-rings, (OR-017) between the end blocks and the glass tube. If leaks continue, install a new heat exchanger (test chamber GT-010).

- 4. Leaking flowmeter - Remove pressure. Check to see that O-rings are in place. Hand tighten compression unions.



Heat Flux Curve



**ADPM-1A & ADPM-2A Conversion
Gallons per Minute (gpm) to feet per second (fps)**